DOCUMENT RESUME

ED 438 162 SE 063 161

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TITLE Measurement Activities for Increasing Student Curiosity for Animal and Space Topics.
PUB DATE 1999-00-00
NOTE 70p.
PUB TYPE Guides - Classroom - Teacher (052)
EDRS PRICE MF01/PC03 Plus Postage.
DESCRIPTORS *Animals; Elementary Education; Mathematics Activities; *Measurement; Science Education; *Space Sciences

ABSTRACT

This document presents a resource for elementary teachers in the form of a collection of facts and measurements of animals and planets to be used in generating student interest for these different topics. It is suggested that the teacher make an overhead transparency of the measurements related to the current topic, then have students guess at what is being measured. Part of this activity, aside from arousing student curiosity, allows the teacher to diagnose what students know about the topic and focus their attention. Measurements for the animal and solar system topics include: (1) "Sharks" (Deborah Smith); (2) "Bats" (Sharissa Entrichel and Liz Osvold); (3) "Brown Rats" (Jolene Dockstader); (4) "Blue Whales" (John Pattis); (5) "The Solar System: Mars" (Cindy Hurst); and (6) "The Solar System: Saturn" (Lupe Rodriguez). (Contains 75 references.) (ASK)

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ED 438 162

Measurement Activities for Increasing Student Curiosity for Animal and Space Topics

Audrey C. Rule,

Tyler Targee, Lindsey McFerrin, Rachael Ankeny, Amanda McGee, Deborah Smith, Sarah Compton, Trent Reynolds, Brooke Farlow, John Walker, Sharissa Entrichel, Liz Osvold, William Cook, Janene Uhlman, Barbara Whitman, Rita Olson, Wendy Scofield, Erin Clem, Jill Kukol, Jolene Dockstader, Jill Haunold, Debbie Watkins, Jen Wieber, Danielle Bell, Maria M. Clark, Amy Foley, Hayley McKlveen Miller, Viola White, John Pattis, Cori Bitz, Cindy Hurst, Carmen Figueras, Lupe Rodriguez, and Melissa Coto

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Introduction

Authors

The materials presented here were developed by education preservice teachers participating in a mathematics and science curriculum and instruction course taught by Dr. Audrey Rule and by graduate students in curriculum and instruction at Boise State University.

Purpose

These materials are intended for use by classroom teachers to generate student curiosity during an anticipatory set of a lesson or at the beginning exploration phase of a learning cycle lesson. Several different animal and solar system topics are presented.

How to use the materials

The teacher should select a page from this manuscript that relates to the topic of interest. Information is presented in two ways – as a page highlighting metric measurements and as a page highlighting English customary measurements. Choose the measurement system with which students are most familiar. Then, make an transparency of the page for use on an overhead projector.

Part of the purpose of this activity, aside from arousing student curiosity, is to allow the teacher to diagnose what students know about the topic and to focus students' attention. Present the measurements as a guessing game by covering the right side of the transparency with a sheet of paper. Students should be told the topic to which the measurements relate, but not be allowed to see exactly what each dimension is

measuring or counting. Ask students to guess, for example, what part, related item, or aspect of bald eagles weighs 100 pounds. The teacher can record the guesses on the board or another overhead transparency. Encourage students to give reasons for their guesses. Move to the next measurement until all of the measurements on the transparency have been discussed. Then it is time to reveal the answers one by one and see how close students came with their guesses. Students will be intrigued with the answers and excited to learn more about the topic.

Suggested activities for expansion

- After students have experienced a lesson using measurements in this way, encourage them to research facts about their favorite animals, planets, or events and create their own measurement guessing game activity.
- Students can make books about the topic studied, illustrating each measurement by drawing arrows on a picture and elaborating on how this dimension helps the organism to survive or relates to a common experience.
- Measurement facts make interesting interactive bulletin board displays in which the observer matches each fact with a measurement by positioning an arrow or yarn line.
- Measurement facts can be used to practice using comparative and superlative adjectives. Choose measurements from two animals and ask students to tell which is taller, longer, faster, or heavier. Add another set from another animal and find out which is shortest, smallest, lightest or slowest.
- Use the length of an animal as an alternative unit of measure and measure the room in animal-lengths. Have kids investigate how many animal-lengths tall they are.

- Set up a proportion between the same dimension (length or weight, perhaps) of two different animals. For example, an adult male rat weighs 500 grams and an adult male T-Rex weighed 5.5 metric tons. Convert 5.5 metric tons to grams so that both measurements are in the same units. 5.5 metric tons equal 4,585,788 grams so the ratio is 500: 4,585,788 or approximately $1:10^4$, or T-Rex was one thousand times heavier than a rat.

Tyrannosaurus Rex Metric Measurements

Tyler Targee and Lindsey McFerrin

227 kilograms (500 pounds)	The weight of meat an adult T-Rex is estimated to be able to grab in one bite. This means that a T-Rex could eat 2000 quarter-pound cheeseburgers in one bite (Kallen, p.12).
5.6 meters (18.5 feet)	The average height of an adult Tyrannosaurus Rex. The T-Rex was not very fast because of its large size. T-Rex waited until smaller dinosaurs came close enough for capture (Sattler, p. 295).
5.5 metric tons (6 tons)	The average weight of an adult Tyrannosaurus Rex. It would take sixty to seventy full-size men to equal that weight (Sattler, p. 295).
1 ½ - 2 weeks	The length of time an adult Tyrannosaurus can wait before eating its next meal. It would certainly need a large stomach for a dinosaur of this size to wait so long between meals! (Kallen, p. 17).
0.9 meters (3 feet)	The average distance from upper to lower jaw of an open Tyrannosaurus Rex's mouth. This monstrous jaw size allowed it to pick up smaller dinosaurs whole (Sattler, p.295-296).
60	The number of teeth in a Tyrannosaurus Rex's mouth. These teeth allowed T-Rex to rip apart its prey (MacLeod, p. 8).
8-15 cm (3-6 inches)	The length of an adult's teeth. Some of these teeth were longer than a banana and sharp as a knife! (Sattler, p. 296).
2 of these with 2 on each	Two arms with two claws on each. T-Rex would often hold its dead prey with these claws as it fed (MacLeod, p. 7)..
76 cm (30 inches)	Average length of adult arms. These arms were so short that a T-Rex could not even scratch its own chin (Sattler, p.296).
65 to 70 million years	Approximately how many years ago the Tyrannosaurus Rex lived. Bones of T-Rex have been found in North America and have been buried here since Late Cretaceous times (Kallen, p. 4).

Tyrannosaurus Rex Customary Measurements

Tyler Targee and Lindsey McFerrin

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Bald Eagle Metric Measurements

Rachael Ankeny and Amanda McGee

7.5 cm (3 inches)	The length of the hallux or hind claw of an eagle. The bald eagle's exceptionally large, muscular feet are an additional aid in hunting (Clark, 1983, p. 822).
1 – 3, usually 2	The number of dull white eggs in a clutch, usually laid two to four days apart (Walters, 1994, p. 104).
2.2 meters (7 feet, 2.5 inches)	The average width of an adult female wingspan. Male wingspans are somewhat smaller (Bortolotti, 1984, p. 72).
45-51 km per hour (28-32 miles per hour)	The average speed of an adult eagle flapping calmly through the air Clark, 1983, p.826).
31-46 days	The length of time that eggs are incubated (Walters, 1994, p. 104).
9 – 10 weeks	The time at which a chick is nearly full grown and takes its first flight (Brown, 1968, p. 187).
4 – 5 years	Age at which males have white feathers on their heads (Bortolotti, 1984, p. 8).
3.7 x 2.6 meters (12 x 8.5 feet)	The average size of an eagle's nest (Harrison, 1979, p. 69).
45.4 kilograms (100 pounds)	The usual weight of an older nest (Harrison, 1979, p. 70).
30 - 40 years	The time span that eagle mates will keep adding to a nest (Harrison, 1979, p. 69).

Bald Eagle Customary Measurements

Rachael Ankeny and Amanda McGee

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Shark Metric Measurements

Deborah Smith

13.7 meters (45 feet)	Length of the largest species of shark, the whale shark (Springer and Gold, 1989).
25 - 100 Hertz	The frequency range of sounds a shark can hear (Springer and Gold, 1989).
2 - 4.8 km per hour (1.2 to 3 miles per hour)	The speed at which a shark in captivity generally swims (Stevens, 1987).
32 of 350	The number of species of sharks (of the total number of species) implicated in attacks on humans (Compagno, 1981)
19 – 22 cm (6.4 – 6.9 inches)	The length of the smallest species of shark, the dwarf dog shark (Springer and Gold, 1989).
12, 088 kilograms (13 tons)	The weight of a shark of the largest species, the whale shark (Clark, 1981).
380 million years	The length of time sharks have been on earth (Stevens, 1987).
250 meters (820 feet)	The distance at which sharks can still hear sounds (Springer and Gold, 1989).
25 years	The average life span of a shark (Stevens, 1987).
1 – 10 %	The percent of its total body weight a shark eats each week (Springer and Gold, 1989).

Shark Customary Measurements

Deborah Smith

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Penguin Metric Measurements

Sarah Compton and Trent Reynolds

1 –2, usually 2

The number of eggs laid by the female penguin. The male is the one who incubates the egg by holding it on his feet under his feathers (Stone, 1987)

0.4 – 1 meter
(16 inches – 3.5 feet)

The range in height between the smallest and largest penguins. The Little Blue Penguin is the smallest species. The largest species is the Emperor Penguin (Arnold, 1988).

1 – 41 kilograms
(2.5 – 90 pounds)

The range in weight between the smallest and largest penguins (Arnold, 1988). Adult Little Blue Penguins are sometimes called fairy penguins because they are so small.

76 millimeters
(3 inches)

The average length of a penguin's egg from tip to tip. A female penguin lays eggs two to four days apart (Johnson, 1981).

38-42 days

The incubation period of an egg. After this time, the chick will begin to break out of the shell (Johnson, 1981).

100 grams
(3.5 ounces)

The average weight of a penguin chick at hatching. Chicks are covered in soft feathers called down, which don't protect them much from the cold. They find shelter and warmth under their parents until they are too big to fit. (Johnson, 1981 and Stone, 1987).

2 months

The age at which a chick eats an adult diet. A parent dives into the water and catches a fish, holding it in its throat for the chick to take (Serventy, 1983).

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More Penguin Metric Measurements

Sarah Compton and Trent Reynolds

11 per square cm
(70 per square inch)

Number of feathers on an adult penguin. This thick coat of feathers and a layer of fat gives the penguins enough insulation to endure extreme cold (Arnold, 1988).

24 km per hour
(15 miles per hour)

The fastest recorded speed of a swimming penguin. Penguins are aerodynamically shaped and use their webbed feet as rudders. They "fly" in the water.

274 meters
(900 feet)

The deepest recorded dive of a penguin: an Emperor Penguin, a champion diver (Arnold, 1988).

20 minutes

The amount of time a penguin can hold its breath. Staying under the water helps a penguin avoid any predator that may be flying above.

32 ° C
(90 ° F)

The temperature inside a penguin egg. A penguin must endure temperatures of –50 degrees F (-45 degrees C) while trying to keep the egg warm. A penguin nesting area is called a rookery (Arnold, 1988)

17 and 6

There are 17 species and 6 groups of penguins (Stone, 1987).

More Penguin Customary Measurements

Sarah Compton and Trent Reynolds

70 per square inch
(11 per square cm)

Number of feathers on an adult penguin. This thick coat of feathers and a layer of fat gives the penguins enough insulation to endure extreme cold (Arnold, 1988).

15 miles per hour
(24 km per hour)

The fastest recorded speed of a swimming penguin. Penguins are aerodynamically shaped and use their webbed feet as rudders. They "fly" in the water.

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(274 meters)

The deepest recorded dive of a penguin: an Emperor Penguin, a champion diver (Arnold, 1988).

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90 ° F
(32 ° C)

The temperature inside a penguin egg. A penguin must endure temperatures of –50 degrees F (-45 degrees C) while trying to keep the egg warm. A penguin nesting area is called a rookery (Arnold, 1988).

17 and 6

There are 17 species and 6 groups of penguins (Stone, 1987).

Cheetah Metric Measurements

Brooke Farlow and John Walker

110 kilometers p h (68 miles per hour)	The top speed of an adult cheetah (Lumpkin, 1993, p. 43).
0 to 110 km p h in 2 sec (0 to 68 mph in 2 sec)	Acceleration rate of an adult cheetah (Lumpkin, 1993, p 43).
33- 55 kilograms (88 - 145 pounds)	Maximum weight of an adult cheetah (Stonehouse, 1999, p. 26).
777 square km (300 square miles)	A female cheetah's territory (Lumpkin, 1993, p. 44).
40 square kilometers (15 square miles)	A male cheetah's territory (Lumpkin, 1993, p. 44).
8 years	Life expectancy of a healthy cheetah (Lumpkin, 1993, p. 44).
14 to 18 months	Length of time cub stays with the mother (Lumpkin, 1993, p. 45).
2 meters (79 inches)	Length of an adult cheetah (Lumpkin, 1993, p. 45).
9 out of 10	Number of cubs that die (mortality rate) before reaching the age of three months old (Stonehouse, 1999, p. 26).
7 meters (23 feet)	Distance covered between strides of an adult cheetah (distance between right front leg touching ground again) (Seddon, 1988, p. 37).
8 - 10 square km (3-4 square miles)	Area of grassland space needed by one cheetah (Stonehouse, 1999, p. 27).

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Bat Metric Measurements

Sharissa Entrichel and Liz Osvold

6 grams
(0.25 ounce)

Weight of the horseshoe bat. This bat has the same wing structure as North American bats, but lives in Asia (Johnson, 1985, p. 8).

16 weeks

Average gestation period. Young bats develop in their mothers' bodies before being born into a nursery cave where generations of bats have reared their young (Johnson, 1985, p. 24).

2,500 kilometers
(1,500 miles)

Migration distance of the Mexican free-tailed bat from the southwestern United States to Mexico (Johnson, 1985, p. 36).

25 beats per minute

Heart rate of a hibernating bat. When the weather becomes cold, a bat's body temperature can drop close to freezing and the heart slows from 400 to just 25 beats per minute (Johnson, 1985, p. 36).

1.8 meters
(6 feet)

Wingspan of the flying fox bat, the largest bat in the world (Wood, 1991, p. 10).

20 million

Number of Mexican free-tailed bats that occupy Bracken Cave in Texas. This is the largest concentration of warm-blooded animals in the world (Ackerman, 1997, p. 6).

2 grams
(0.08 ounce)

Weight of the adult bumblebee bat, the smallest bat in the world. This bat from Thailand has the official name of Kitti's Hog-nosed bat (Ackerman, 1997, p. 9).

15 years

Average bat life span. Some bats are capable of living as many as 34 years (Ackerman, 1997, p. 9).

90498 kilograms
200 tons

Amount of insects eaten in a night by Bracken Cave bats. Bats are a natural pesticide because they eat insects that can harm crops and bring disease (Ackerman, 1997, p. 9).

60 km per hour
35 miles per hour

Speed at which a bat can fly. As they fly, bats revolve around one another to gain speed and height (Ackerman, 1997, p. 9).

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Grizzly Bear Metric Measurements

Bill Cook, Janene Uhlman, and Barbara Whitman

10 centimeters (4 inches)	Front claw length of adult grizzly bear (Larrison, 1976, p. 169).
1 – 4, usually 2	The size of a litter born at one time to a female grizzly bear (Larrison, 1976, p. 169).
15 – 34 years (180-408 months)	The life span of a grizzly bear (Walker, 1964, p. 1173).
42	Average number of teeth (Olsen, 1992, p. 47).
90 kilograms (41 pounds)	Average weight of yearling grizzly bear (Walker, 1964, p. 1173).
280 – 780 grams (10 – 24 ounces)	Range of birth weight of a cub (Olsen, 1992, p. 47).
146 – 382 kilograms (325 – 850 pounds)	Weight range of adult male grizzly bear (Olsen, 1992, p. 13).
6 months	Gestation period for grizzly bear. After giving birth, most females do not mate again for 3 or 4 years (Burt, 1976, p. 47).

Grizzly Bear Customary Measurements

Bill Cook, Janene Uhlman, and Barbara Whitman

4 inches (10 centimeters)	Front claw length of adult grizzly bear (Larrison, 1976, p. 169).
1 – 4, usually 2	The size of a litter born at one time to a female grizzly bear (Larrison, 1976, p. 169).
15 – 34 years (180-408 months)	The life span of a grizzly bear (Walker, 1964, p. 1173).
42	Average number of teeth (Olsen, 1992, p. 47).
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More Grizzly Bear Metric Measurements

Bill Cook, Janene Uhlman, and Barbara Whitman

402 square km (251 square miles)	Female grizzly's home range in the Silkirk Mountains of Northern Idaho (National Wildlife Federation, 1987, p. 28).
40-50 beats per m 8-12 beats per m	The differences in heart rate while active and during winter sleep (National Wildlife Federation, 1987, p. 21).
56 km per hour (35 mph)	Top speed an adult grizzly bear can travel. Typical speed is 30 miles per hour (Olsen, 1992, p. 18).
180 – 213 cm (5.9 – 7 feet)	The overall head – body length of adult grizzlies (Hare, 1999, p. 77).
2400 square km (1500 square miles)	Distance traveled by male grizzlies to find a mate. The normal mating period is 2 – 15 days (Olsen, 1992, p. 25).
48 – 64 kilometers (30 – 40 miles)	Distance at which a grizzly can detect the scent of a rotting carcass (Olsen, 1992, p. 23).
2.5 centimeters (1 inch)	Average length of claws on the rear paws of a grizzly (Olsen, 1992, p. 13).

More Grizzly Bear Customary Measurements

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5.9 – 7 feet (180 – 213 cm)	The overall head – body length of adult grizzlies (Hare, 1999, p. 77).
1500 square miles 2400 square km	Distance traveled by male grizzlies to find a mate. The normal mating period is 2 – 15 days (Olsen, 1992, p. 25).
30 – 40 miles (48 – 64 kilometers)	Distance at which a grizzly can detect the scent of a rotting carcass (Olsen, 1992, p. 23).
1 inch (2.5 centimeters)	Average length of claws on the rear paws of a grizzly (Olsen, 1992, p. 13).

Leatherback Turtle Metric Measurements

Rita Olson, Wendy Scofield, Erin Clem, and Jill Kukal

200 million years	The length of time that leatherback turtles have existed on Earth (Lambert, 1997).
2 meters (7 feet)	The average length of a leatherback turtle (Gibbons, 1995).
567 kilograms (1,500 pounds)	The maximum weight of a leatherback turtle (Lambert, 1997).
32 km per hour (20 miles per hour)	The speed at which a leatherback turtle can swim (Gibbons, 1995).
3,937 feet (1,200 meters)	The deepest that a leatherback turtle can dive (Dorling Kindersley, 1995).
7	The number of ridges on a leatherback turtle's back (Gibbons, 1995).
2	The number of parts to a leatherback turtle shell (Gibbons, 1995).
1 out of 8	The leatherback turtle is the one turtle with a soft shell out of eight types of sea turtles (Gibbons, 1995).
1000 miles (1600 kilometers)	The number of miles a leatherback turtle may migrate (Gibbons, 1995).
2-3 years	Leatherback turtles mate every two to three years (Gibbons, 1995).

Leatherback Turtle Customary Measurements

Rita Olson, Wendy Scofield, Erin Clem, and Jill Kukal

200 million years	The length of time that leatherback turtles have existed on Earth (Lambert, 1997).
7 feet (2 meters)	The average length of a leatherback turtle (Gibbons, 1995).
1,500 pounds (567 kilograms)	The maximum weight of a leatherback turtle (Lambert, 1997).
20 miles per hour (32 km per hour)	The speed at which a leatherback turtle can swim (Gibbons, 1995).
1,200 meters (3,937 feet)	The deepest that a leatherback turtle can dive (Dorling Kindersley, 1995).
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More Leatherback Turtle Metric Measurements

Rita Olson, Wendy Scofield, Erin Clem, and Jill Kukal

1 hour	The length of time it takes a female to lay her eggs (Gibbons, 1995).
100	Average number of eggs a female leatherback turtle lays (Lambert, 1997).
2 months	The length of time that the eggs develop in the sand before the young turtles hatch (Gibbons, 1995).
3.8 centimeters (1.5 inches)	The diameter of a leatherback turtle egg. It is very similar to a ping pong ball (Rudloe and Rudloe, 1994).
100 years	The life span of the leatherback turtle (Gibbons, 1995).
88.2° Fahrenheit (31° Celsius)	Body temperature of the leatherback turtle
70	Average number of leatherback turtle nesters in Chesapeake Bay, Maryland (Rudloe and Rudloe, 1994).
320 kilometers (200 miles)	The length of the stretch of beach area where the turtles make their nests (Rudloe and Rudloe, 1994).
40 km in 30 hours (25 miles in 30 hours)	Turtle hatchlings must swim twenty-five miles in their first thirty hours of life to find shelter and avoid being eaten by predators. (Rudloe and Rudloe, 1994).
1835	The year that Charles Darwin visited the Galapagos Islands and wrote about the leatherback turtle (Rudloe and Rudloe, 1994, and McCarthy, Arnold, and Keates, 1991).

More Leatherback Turtle Customary Measurements

Rita Olson, Wendy Scofield, Erin Clem, and Jill Kukal

1 hour	The length of time it takes a female to lay her eggs (Gibbons, 1995).
100	Average number of eggs a female leatherback turtle lays (Lambert, 1997).
2 months	The length of time that the eggs develop in the sand before the young turtles hatch (Gibbons, 1995).
1 ½ inches (3.8 centimeters)	The diameter of a leatherback turtle egg. It is very similar to a ping pong ball (Rudloe and Rudloe, 1994).
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Brown Rat Metric Measurements

Jolene Dockstader

16	4 incisors (front) and 12 molars (back) - the number of teeth of a brown rat (Farris & Griffith, 1967, p. 104-105). Compared to an adult human who has twice as many.
5	The number of "fingers" and "toes" on each foot of a brown rat (Olds & Olds, 1979, p. 12). With a total of ten, this is the same as a human.
6	The number of footpads found on each foot of the brown rat (Olds & Olds, 1979, p. 12). The foot pads give them traction like a pair of tennis shoes does for humans.
3	The number of bristles that project from under the edge of each scale on the tale (Olds & Olds, 1979, p. 11). These bristles are not as stiff as those found in a hairbrush and are very soft.
12	The number of teats usually found on a female rat (Olds & Olds, 1979, p. 15).
8	Average number of pups in a litter of brown rats living in the wild (Olds & Olds, 1979, p. 96). Because rats are feed well and are in less danger in the lab, the number of pups rises in a lab setting.
37-60 cm (14.5 - 24 inches)	Average overall length (including tail) of a male brown rat (Olds & Olds, 1979, p. 91). This is about the same length from your fingers to your elbow.
39-47 cm (15 – 18.5 inches)	Average overall length (including tail) of a female brown rat (Olds & Olds, 1979, p. 91).
5 g (0.18 ounce)	The weight of a brown rat when born (Olds & Olds, 1979, p. 91).
500 g (1.1 pound)	The average weight of a male brown rat when full grown (Olds & Olds, 1979, p. 91).

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14.5 – 24 inches (37-60 cm)	Average overall length (including tail) of a male brown rat (Olds & Olds, 1979, p. 91). This is about the same length from your fingers to your elbow.
15 – 18.5 inches (39-47 cm)	Average overall length (including tail) of a female brown rat (Olds & Olds, 1979, p. 91).
0.18 ounce (5 g)	The weight of a brown rat when born (Olds & Olds, 1979, p. 91).
1.1 pounds (500 g)	The average weight of a male brown rat when full grown (Olds & Olds, 1979, p. 91).

More Brown Rat Metric Measurements

Jolene Dockstader

350 g (12 ounces)	The average weight of a female brown rat when full grown (Olds & Olds, 1979, p. 91).
20-44 days	The gestation period of brown rats (Olds & Olds, 1979, p. 97).
360 degrees	The brown rat can see nearly 360 degrees at one time without moving its eye (Olds & Olds, 1979, p. 94). This helps the rat to survive because it can see danger from all sides at all times.
20 kilohertz	The brown rat can make and hear sounds at this level (Olds & Olds, 1979, p. 95). Humans can hear this level but not much above this level.
12-18 months	Life span of brown rat in the wild (Olds & Olds, 1979, p. 103). Rats have many natural enemies that prey upon them for food so they have a shorter life span in the wild.
3 years	Life span of brown rat in the lab (Olds & Olds, 1979, p. 103). In the labs, they are protected from prey and fed well, so they live longer lives.
20 million	The number of rats used each year in laboratories in the United States to test products like medicine (Alderton, 1996, p. 29).
15,000	The number of potential descendents in a year from a single pair of brown rats (Alderton, 1996, p. 36). You can see why people try to control the rat population or we would soon be overrun!
200	The number of members in a colony of brown rats living in the wild (Encyclopedia Americana, 1999, p. 265).

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Marathon Husky and Iditarod Race Metric Measurements

Jill Haunold

1668 kilometers

(1049 miles)

The average length of the Iditarod cross country race in Alaska. This race is always over 1000 miles (1609 kilometers), but is referred to as a 1049 mile race with the 49 signifying Alaska as the 49th state of the United States (Iditarod Trail Committee, 1999).

10,000 calories

The number of calories used by marathon huskies during a day of racing the Iditarod (Vanek, 1999, p. 14).

1%

The percent of body weight the heart of a marathon husky weighs. This is the largest percentage of any mammal (Reynols, 1997, p. 10).

161 kilometers

(100 miles)

The number of miles dogs run in a day during the Iditarod (O'Harra, 1997).

32 km per hour

(20 miles per hour)

Average speed of dogs running in the Iditarod race (O'Harra, 1997).

19 kilograms

(50 pounds)

Average weight of a dog running the Iditarod race (O'Harra, 1997).

9 days, 2 hours, 42 minutes, and 19 seconds

Record time for the over thousand mile Iditarod dogsled race. This record was held by Doug Swingly of Montana (Medred, 1997a)

7.5 kilograms

(20 pounds)

Weight of unloaded toboggan sleds pulled during the Iditarod (Medred, 1997b).

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Whale Metric Measurements

Debbie Watkins

4538 kg (Blue Whale)
(6 tons)

Weight of a Blue Whale tongue (Stonehouse, 1978, p. 4).

16 months (Sperm Whale)

Length of gestation period. This is how long it takes for a baby whale (calf) to grow inside the mother before it is born (Stonehouse, 1978, p. 10).

50 – 80 years
(Blue Whale)

The life span of a blue whale. The age of any whale can be determined by measuring the waxy build-up in its ears (Stonehouse, 1978, p. 11).

22.5 meters (Blue Whale)
(74 feet)

A Blue Whale grows this much in its first year of life. At birth the whale calf is 26 feet (8 m) long and will grow to 100 feet (30.5 m) in the first year! (Stonehouse, 1978, p. 17).

2.5 meters (Narwhale)
(8 feet)

Length of the one and only tusk. The Narwhale is a gray Arctic whale that grows this single, spiraling ivory tusk. This may be the origin of the idea of the unicorn (Stonehouse, 1978, p. 9).

300 meters (Sperm Whale)
(1,000 feet)

The depth to which the Sperm Whale can dive. The whale dives this deep to hunt for its favorite meal: squid (Stonehouse, 1978, p. 48).

Whale Customary Measurements

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(4538 kilograms)

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8 feet (Narwhale)
2.5 meters

Length of one and only tusk. The Narwhale is a gray Arctic whale that grows this single, spiraling ivory tusk. This may be the origin of the idea of the unicorn (Stonehouse, 1978, p. 9).

1,000 feet (Sperm Whale)
300 meters

The depth to which the Sperm Whale can dive. The whale dives this deep to hunt for its favorite meal: squid (Stonehouse, 1978, p. 48).

More Whale Metric Measurements

Debbie Watkins

50 – 90 minutes
(Sperm Whale)

The length of time at which a Sperm Whale can hold its breath under water. Blue whales can hold their breath for 40 to 45 minutes (Jorgersen, 1982, p. 13).

36.6° Celsius
(98° Fahrenheit)

Body temperature of all whales. Whales are warm blooded mammals and their body temperature is close to our temperature of 98.6 degree Fahrenheit (Jorgersen, 1982, p. 5).

51 - 64 centimeters
(20 – 25 inches)

The thickness of the blubber layer on a whale. The blubber in whales that are slow swimmers is thicker. This fat layer insulates the whale from the cold ocean water (Jorgersen, 1982, p. 10).

473 liters
(125 gallons)

The volume of milk that a nursing baby calf drinks from its mother each day. It takes six months for a human baby to double its weight, but a whale calf doubles its weight in just two weeks! (Tracqui, 1995, p. 19).

25,000 (Humpback Whale)

The number of Humpback Whales that exist today. In 1780, there were still 150,000 Humpbacks, but because so many were hunted and killed, only 25,000 are left. From 1937 to 1987, two million (100 each day) Humpback Whales were killed by humans (Tracqui, 1995, p. 24).

15 (Humpback Whale)

The number of babies a Humpback Whale can bear in her lifetime (Tracqui, 1995, p. 24).

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Humpback Whale Metric Measurements

Jen Wieber

818 kilograms
(0.9 tons)

The weight of a Humpback Whale at birth. A fetus gains most of its weight at the end of pregnancy. A whale calf is usually born flukes first (Dow, 1990, p. 43-44).

5 kilograms
(11 pounds)

The weight of the brain of a Humpback Whale. This is three times larger than the human brain. The cerebral hemisphere of whales are like that of humans. The cortex, or gray matter of the brain, are more like that of sheep, cattle or deer. Their intelligence compares to other large, grazing animals like cattle or giraffes (Green and Sanford, 1985, p. 17).

4.8 meters
(16 feet)

The length of a flipper. Megaptera Novaeanglia, meaning "Big-winged New Englander", is the name scientists give to Humpback whales because of their giant flippers (Green and Sanford, 1985, p. 9).

12 mm
(½ inch)

The thickness of the whale's skin. Humpback Whales have a very thin layer of skin in comparison to their layer of fat. The fat layer is 24 times thicker than the skin (Green and Sanford, 1985, p. 17).

14 years

The number of years that Humpback Whales have been protected. The harpoon gun used by hunters to kill whales was invented by a Norwegian whaler named Svend Foyn. It fired explosive harpoon heads and was widely used for commercial whaling (Goldner and Vogal, 1987, p. 44).

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Humpback Whale Metric Measurements

Danielle Bell

Every 2 to 3 years	A female humpback whale has a calf every two to three years (Zahn, 1988, p. 63).
45 to 60 %	A nursing Humpback Whale's milk has 45 to 60 percent fat content (Calalmbokidis and Weinrich, 1997).
10 to 20 minutes	The length of a Humpback Whale song (Calalmbokidis and Weinrich, 1997).
200 or more	The number of whales in a Humpback Whale pod (group) (Zahn, 1988, p. 63).
4.6 miles per hour (24,304 feet per hour)	A Humpback Whale's normal swimming speed (Cousteau, 1972, p.83).
22,700 to 36,300 kg (25 to 40 tons)	The average weight of a Humpback Whale (Calalmbokidis and Weinrich, 1997).
46 kilometers (75 miles)	The distance Humphrey the whale traveled up the Sacramento River while he was "lost" (Zahn, 1988, p. 110).
$20,000.00	The fine for harassing Humphrey the Whale. While lost, Humphrey was put under federal protection by the National Fisheries Service. They set the fine for "visible harassment of Humphrey" (Zahn, 1988, p. 110).
8,000	The estimated number of Humpback Whales in the North Pacific Basin (Southern British Columbia, Washington, California, and Baha Mexico) (Calalmbokidis and Weinrich, 1997).

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4 knots per hour (24,304 feet per hour)	A Humpback Whale's normal swimming speed (Cousteau, 1972, p. 83).
25 to 40 tons 22, 680 to 36,287 kg	The average weight of a Humpback Whale (Calalmbokidis and Weinrich, 1997).
75 miles 46 kilometers	The distance Humphrey the whale traveled up the Sacramento River while he was "lost" (Zahn, 1988, p. 110).
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Killer Whale Metric Measurements

Maria Clark

2.4 meters (8 feet)	The length of an Orca calf at birth (Stone, 1987, p. 29).
16 months	The length of the gestation period – the time that a whale is pregnant. Babies are born tail first (Stone, 1987, p. 29).
9 meters (30 feet)	The length of a male Orca, or bull (Stone, 1987, p. 19).
7,200 kilograms (8 tons)	The weight of a bull Orca (Stone, 1987, p. 19).
1.8 meters (6 feet)	The height of the triangular-shaped dorsal fin of male Orcas (Patent, 1984, p. 61).
56 kilograms (125 pounds)	The amount of fish needed to feed a captive male Orca for one day (Brett, 1992, p. 23).
48 km per hour (30 miles per hour)	The speed of a swimming killer whale. Orcas are faster than almost any other animals in the sea (Stone, 1987, p. 21).
40	The number of teeth of a killer whale (Stone, 1987, p. 21).
8 centimeters (3 inches)	The length of killer whale teeth. Each tooth points inward (Stone, 1987, p. 21).
37° Celsius (99° Fahrenheit)	The internal body temperature of a killer whale (Stone, 1987, p. 11).

Killer Whale Customary Measurements

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Gray Whale Metric Measurements

Amy Foley

1,135 kilograms
(2,500 pounds)

The weight of a newborn baby Gray Whale. The baby whale is born tail first and averages 13 feet long.

16 kilograms
(35 pounds)

The amount of weight a baby Gray Whale gains in a day by nursing milk from its mother.

10,000 miles
(16,000 kilometers)

The distance of the Gray Whales' incredible migration during a year. Every fall Gray Whales migrate from the cold Arctic to the oceans off Mexico. In these warm waters they rest and have their babies. They return to the Arctic feeding grounds in the spring.

2

The number of blowholes each Gray Whale has. A whale's nose is called a blowhole. It is on top of the whale's head so that the whale can breathe without coming very far out of the water. Each type of whale sends up a spout in a different shape.

136 kilograms
(300 pounds)

The amount of food swallowed in one feeding. The whale fills its mouth over and over until it has swallowed 300 pounds of krill – small shrimp-like crustaceans.

15.2 meters
(50 feet)

The maximum length of the Gray Whale

25,402 kilograms
(56,000 pounds)

The maximum weight of the Gray Whale. The Gray Whale is a baleen whale of rather large size. Gray Whales spend much time close to shore eating plankton, krill, and fish.

Gray Whale Customary Measurements

Amy Foley

2,500 pounds
(1135 kilograms)

The weight of a newborn baby Gray Whale. The baby whale is born tail first and averages 13 feet long.

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(16 kilograms)

The amount of weight a baby Gray Whale gains in a day by nursing milk from its mother.

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Sperm Whale Metric Measurements

Hayley McKlveen Miller

50 – 90 minutes

The length of time that a sperm whale can hold its breath under water (Stonehouse, 1978, p. 10).

16 months

Gestation period. The baby whale takes this long to grow inside its mother before it is born (Stonehouse, 1978, p. 48).

305 meters
(1000 feet)

Sperm whales hunt for their food at approximately this depth (Jorgersen, 1982, p. 13).

1,900,000

The number of Sperm Whales existing today. The numbers have declined drastically because of human hunting (Whales in Danger, 1999, p. 1).

34,000 – 53,000 kg
(45 -70 tons)

The weight of a male Sperm Whale (Whales in Danger, 1999, p. 1).

51.8 – 60.7 feet
(15.8 – 18.5 meters)

The length of a male Sperm Whale (Whales in Danger, 1999, p. 1).

Sperm Whale Customary Measurements

Hayley McKlveen Miller

50 – 90 minutes	The length of time that a sperm whale can hold its breath under water (Stonehouse, 1978, p. 10).
16 months	Gestation period. The baby whale takes this long to grow inside its mother before it is born (Stonehouse, 1978, p. 48).
1000 feet (305 meters)	Sperm whales hunt for their food at approximately this depth (Jorgersen, 1982, p. 13).
1,900,000	The number of Sperm Whales existing today. The numbers have declined drastically because of human hunting (Whales in Danger, 1999, p. 1).
45 -70 tons (34,000 – 53,000 kilograms)	The weight of a male Sperm Whale (Whales in Danger, 1999, p. 1).
15.8 – 18.5 meters (51.8 – 60.7 feet)	The length of a male Sperm Whale (Whales in Danger, 1999, p. 1).

Sperm Whale Metric Measurements

Viola White

18 meters
(60 feet)

The length of a full-grown male sperm whale (Whitehead, 1994, p. 781).

19.4 kilograms
(43 pounds)

The weight of a Sperm Whale's brain. Sperm Whales have the biggest brains compared to other animals their size. Their brains weigh fifteen times as much as human brains (Berger, 1999, p. 14).

35.5 centimeters
(14 inches)

Thickness of skin. Sperm whale skin is very thick and is lined with one to two feet of blubber (Berger, 1999, p.15).

25 on each side

Number of teeth on each side of the lower jaw (Kinney).

13,600 – 63,500 kg
(15 – 70 tons)

The range in weight of Sperm Whales (Kinney).

2.4 kilometers
(1.5 miles)

The maximum length of the Gray Whale
The depth to which a Sperm Whale can dive. Sperm Whales dive deeper than any other whale (Berger, 1999, p. 23).

1-2 hours

Length of time a Sperm Whale can hold its breath. This is longer than any other whale (Berger, 1999, p. 23).

100 years

The life spans of some Sperm Whales. Larger Sperm Whales can live up to 100 years but few reach this age because of starvation or disease (Berger, 1999, p. 18).

1,893 liters
(500 gallons)

The amount of oil in a mature male Sperm Whale's head (Whitehead, 1995, p. 65).

Sperm Whale Customary Measurements

Viola White

60 feet (18 meters)	The length of a full-grown male sperm whale (Whitehead, 1994, p. 781).
43 pounds (19.4 kilograms)	The weight of a Sperm Whale's brain. Sperm Whales have the biggest brains compared to other animals their size. Their brains weigh fifteen times as much as human brains (Berger, 1999, p. 14).
14 inches (35.5 centimeters)	Thickness of skin. Sperm whale skin is very thick and is lined with one to two feet of blubber (Berger, 1999, p.15).
25 on each side	Number of teeth on each side of the lower jaw (Kinney).
15 – 70 tons (13,608 – 63,503 kg)	The range in weight of Sperm Whales (Kinney).
1.5 miles (2.4 km)	The maximum length of the Gray Whale The depth to which a Sperm Whale can dive. Sperm Whales dive deeper than any other whale (Berger, 1999, p. 23).
1-2 hours	Length of time a Sperm Whale can hold its breath. This is longer than any other whale (Berger, 1999, p. 23).
100 years	The life spans of some Sperm Whales. Larger Sperm Whales can live up to 100 years but few reach this age because of starvation or disease (Berger, 1999, p. 18).
500 gallons (1893 liters)	The amount of oil in a mature male Sperm Whale's head (Whitehead, 1995, p. 65).

Blue Whale Metric Measurements

John Pattis

136,000 kilograms
(300,000 pounds)

The weight of the largest Blue Whale ever caught. It was 100 feet (31 meters) long .It is now on display in the Smithsonian Museum (Dozier, 1977, p. 32). By comparison, African elephants weigh only 9000 pounds. This Blue Whale weighed more than 32 elephants!

3.6 kilograms
(8 pounds)

The hourly growth rate of a baby whale that is nursing from its mother (American Cetacean Society, 1999, p. 1).

48 km per hour
(30 miles per hour)

The maximum speed a Blue Whale can swim (American Cetacean Society, 1999, p. 1).

40,000,000

The number of krill that a Blue Whale eats in a day (American Cetacean Society, 1999, p. 1). Blue Whales are part of the baleen whale family. They have baleen sweepers instead of teeth that sieve the krill out of the water. In one day, a Blue Whale can eat an entire ton of krill!

2%

The approximate percentage of the original Blue Whale population that remains today (11,000 whales) (American Cetacean Society, 1999, p. 1).

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8 pounds
(3.6 kilograms)

The hourly growth rate of a baby whale that is nursing from its mother (American Cetacean Society, 1999, p. 1).

30 miles per hour
(48.3 km per hour)

The maximum speed a Blue Whale can swim (American Cetacean Society, 1999, p. 1).

40,000,000

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The Solar System: The Sun Metric Measurements

Cori Bitz

250 million earth years	The time it takes for the Sun to revolve around the galaxy (National Aeronautics and Space Administration, 1999, p. 1).
17 earth years	Travel time to the Sun in a 747 Jumbo Jet. Plan to spend over a quarter of your lifetime just traveling (Rathbun, 1989, p. 17)
36 earth days	Rotational period for the polar regions of the Sun. The Sun rotates, but because it is a gigantic gaseous sphere, not all parts rotate at the same speed. This is called differential rotation. The polar regions rotate more slowly than the equatorial regions (National Aeronautics and Space Administration, 1999c, p. 1).
1,390,000 km (863,890 miles)	The diameter of the Sun at the equator. This large Sun is our main source of energy and heat (National Aeronautics and Space Administration, 1999c, p. 1).
149,640,000 km (93,000,000 miles)	The distance of the Sun from the Earth (Rathbun, 1989, p. 17).

The Solar System: The Sun

Cori Bitz

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The diameter of the Sun at the equator. This large Sun is our main source of energy and heat (National Aeronautics and Space Administration, 1999c, p. 1).

93,000,000 miles
(149,637,000 kilometers)

The distance of the Sun from the Earth (Rathbun, 1989, p. 17).

More Sun Metric Measurements

Cori Bitz

28 times that of earth	The Sun's gravitational pull. Gravity is the force of attraction between two objects and depends on the mass of the objects and their distance apart. Because the Sun is so massive, its gravitational pull keeps everything in our solar system together (National Aeronautics and Space Administration, 1999c, p. 1).
12,700 kilograms (28,000 pounds)	The weight of a 100 pound person on the Sun because of the higher gravitational field (Rathbun, 1989, p. 17).
8 minutes	The time it takes light from the sun to reach earth, or the time it would take humans to travel to the sun at the speed of light (Rathbun, 1989, p. 17).
15,000,000° Celsius (27,000,000° F)	The Sun's core temperature. The Sun is a medium size star or "yellow dwarf (National Aeronautics and Space Administration, 1999c, p. 1).

More Sun Customary Measurements

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The Solar System: Mars Metric Measurements

Cindy Hurst

687 days	The length of a year on Mars, measured in Earth days. A Martian year is 43 days shorter than two Earth years (Carr, 1981, p.3).
200 – 300 km per hour (124 –186 miles per hour)	Wind velocity during some dust storms. Mars is plagued with ferocious dust storms. Using the information sent back by Mariner 9, McCauley of the U. S. Geological Survey estimated that erosion evident in the photos could have been caused by the strong winds (National Aeronautics and Space Administration, 1976, p.111).
24 hours 39 minutes	The length of a day on Mars. A day is the amount of time it takes for a planet to rotate completely on its axis. A day on Mars is just 39 minutes longer than an Earth day (Carr, 1981, p. 1)
25 degrees	The angular tilt of the rotational axis of Mars. The axis is an imaginary line that runs through the planet from north to south pole. In comparison, Earth's axis is 23 ½ degrees (National Aeronautics and Space Administration, 1999a).
2	The number of Martian moons. Mars's two moons are named Phobos and Deimos. They were discovered by Asaph Hall in 1877 (National Aeronautics and Space Administration, 1976, p.163).
25 kilometers (15.5 miles)	The height of Olympus Mons, the tallest volcano on the planet. This huge volcano is over 700 km (435 miles) across at its base. The largest volcano on Earth, Mauna Loa, has a summit of 9 km (5.6 miles), and is 120 km (74.6 miles) across at its base (Carr, 1981, p. 15).
-133 to +23° C (-207 to + 73.4° F)	Low and high temperatures at the Martian surface. The low temperature was recorded at Mars's south pole, while the high temperature was recorded at the southern latitudes during the summer (Cattermole, 1992, p.2).

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The Solar System: Jupiter Metric Measurements

Carmen Figueras

9,982° Celsius
(18,000° Fahrenheit)

The temperature of the hydrogen of which Jupiter is composed. Jupiter has no solid surface, but it does have a layer of liquid hydrogen (Rathbun, 1989, p. 61).

9 hours 55 minutes

The time it takes Jupiter to make a complete rotation on its axis. Jupiter's day is the shortest in the solar system. This rapid rotation helps to divide the clouds into bands (Rathbun, 1989, p. 63)

143,000 kilometers
(88,875 miles)

The diameter of Jupiter at its equator. Jupiter is the largest planet in the solar system. (National Aeronautics and Space Administration, 1999d, p. 1).

11.78 Earth years

The time it takes Jupiter to make a complete revolution around the Sun (Rathbun, 1989, p. 69).

115 kilograms
(254 pounds)

The weight on Jupiter of a person who weighs 100 pounds on Earth. Jupiter's strong gravity pulls on nearby bodies (National Aeronautics and Space Administration, 1999d, p. 1).

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The Solar System: Saturn Metric Measurements

Lupe Rodriguez

9.539 AU	The average distance from the sun in terms of earth's distance from the sun. AU is the average distance from Earth to the Sun. So, Saturn is over 9 ½ times as far from the Sun as Earth.
97%	The percentage of Saturn's atmosphere that is hydrogen. The atmosphere is made up of hydrogen, helium, and methane (National Aeronautics and Space Administration, 1999b, p1).
270,000 kilometers (167,770 miles)	The diameter of Saturn's rings. Saturn is the second largest planet in our solar system. If Saturn were hollow, about 750 planet Earths would fit inside it (Rogan, 1997, p. 37).
18	Saturn has 18 known satellites, or moons – the most of any planet in our solar system (Morrison, 1982).
100 million to 200 million years	The estimated age of Saturn's rings. The rings are nearly 170 thousand miles across but are less than three miles thick and some are even thinner (Rogan, 1997, p. 36).

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The Solar System: Pluto Metric Measurements

Melissa Coto

37 kilograms
(81 pounds)

The weight on Pluto of a person who weighs 100 pounds (46 kg) on Earth. Pluto has a smaller gravitational pull than Earth because it is a much smaller planet (Rathbun, 1986, p. 75).

-204° Celsius
(-400° Fahrenheit)

The temperature of Pluto's surface. When Pluto and Neptune cross paths so that Pluto moves two billion miles closer to the Sun, its temperature rises 50 degrees from -400° F to –350° F. (Rathbun, 1986, p. 78).

20 years

The recent length of time that Pluto was not the farthest planet from the Sun (Rathbun, 1986, P. 78). Pluto has an unusual orbit that allows it to cross paths with Neptune. When Pluto is the only planet with such an unusual orbit.

19,308 km
(12,000 miles)

The distance from Pluto's surface to its moon. Pluto has only one moon, Charon. Charon is almost ½ the size of Pluto (Rathbun, 1986, p. 79).

584,000 days

The time it would take to travel across the diameter of Pluto's orbit if traveling at 500 mph. Traveling at this same speed, it would only take 7,665 days to travel from the Sun to Earth. Pluto is a long way off! (Gribbin, 1994, p.14)

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